Staff Analysis of Proposed Amendment to the *Dane County Water Quality Plan*, Revising the Cross Plains Sewer Service Area Boundary and Environmental Corridors in the Town of Berry and Village of Cross Plains

1) Existing Conditions

a) Land Use

The requested amendment area is located in the Town of Berry (see Map 1). The 182 acre site is contiguous to the Cross Plains Service Area for approximately 1,600 feet along the amendment area's southeastern corner. The area is located west of the northernmost segment of Brewery Road, north of the current Village limits.

Surrounding Land Uses Include:

- North — Agriculture, Open Space, Woodland
- South — Woodland, Residential
- West — Woodland, Agriculture, Open Space;
- East — Residential, Woodland, Open Space

Existing Land Use	Acres
Agriculture	83.5
Woodlands	49.2
Open Land	32.8
Residential	10.2
Transportation, Communications and Utilities	4.7
Under Construction	1.5
TOTAL	181.9

Proposed Land Use	Proposed Acres	Env. Corridor Acres
Single Family Residential	86.0	6.9
Planned Neighborhood	34.4	
Parkland Conservancy	29.3	29.3
Right of Way	19.4	
Existing Large-lot Residential on Septic	6.9	
Parks	3.6	3.6
Stormwater Management	2.1	2.1
Parking	0.2	
TOTAL	181.9	41.9
NET DEVELOPABLE[1]	135.3	

[1] Net Developable = Total acreage – existing right-of-way – environmental corridor

The Ice Age Trail is southwest of the amendment area. The view shed from the trail will be preserved by a minimum 80 foot wide wooded buffer between the trail and the rear lot line of the proposed residential development in addition to the requirements of the Village's woodlands overlay district to preserve the existing trees in the residential rear lots (See Map 2).

At the time of publication of this staff analysis, the proposed amendment was only partially consistent with the *Village of Cross Plains Comprehensive Plan*. While the Plan identifies the amendment area as a growth area and its future use is "Planned Neighborhood," the description of the goals, objectives, and policies of land development in the Plan requires provision of municipal services in these areas. The Plan further recommends the avoidance of developing such areas (i.e. with steep topography) where such services are impractical, not adequately planned for, and/or are cost prohibitive. The Village has posted a public hearing notice for a Comprehensive Plan Amendment to change the land use of areas within and around the proposed Service Area amendment to "Single-Family Urban." In addition, changes are proposed to language within the Plan which would allow exemption from the requirements for municipal services on a case-by-case basis by the Village. The hearing and decision on amending the Plan will occur Monday, September 11, 2017.

The amendment area is described in the *2012 Town of Berry Comprehensive Plan* as being predominantly "Possible Rural Development Area." This category is described as served by on-site waste disposal systems, limited neighborhood-serving commercial and institutional uses, minimum lot sizes of 1 acre, and utilizing conservation neighborhood design standards. The amendment request conflicts with the Town of Berry's description of the future use of those lands for the time being. However, per Village policy, annexation of the amendment area from the Town of Berry, will occur only *after* the Village has a binding agreement in place with the developer. One condition of that agreement is inclusion within the Sewer Service Area.

b) Cultural and Historic Sites

The Wisconsin Historical Society has been contacted regarding the presence of any known archaeological sites or cemeteries within the amendment area. Their review of the application concluded that there are no previously recorded archaeological sites within the amendment area and that the amendment area has a low potential for cultural or historic sites.

c) Natural Resources

The proposed amendment area is located in the Black Earth Creek Watershed of the Lower Wisconsin River Basin, specifically Brewery Creek on the east and an unnamed tributary on the west (see Map 5). Wastewater from the Village of Cross Plains is treated at the Cross Plains Wastewater Treatment Facility and the treated effluent is discharged to Black Earth Creek on the west side of the Village. There are no wetlands, waterbodies, hydric soils, or floodplains located within the amendment area. There are woodlands present (>80 percent canopy) in the northwest corner of the amendment area and adjacent to the amendment area along the western and southern boundaries. These steep wooded slopes are characteristic of the Driftless Area landscape and generally function as groundwater recharge areas and wildlife corridors.

Brewery Creek

Brewery Creek is a small tributary to Black Earth Creek that enters from the north in the Village of Cross Plains and other agricultural lands further upstream. The stream is 5.3 miles long and drains a 10.5 square mile watershed including the southeastern half of the proposed amendment area. Brewery Creek currently supports a diverse Fish and Aquatic Life (FAL) community with the potential of supporting a coldwater community. The creek provides important habitat for forage fish and for small brown trout. This habitat, however,

is affected by historic modifications such as dredging and ditching. The creek is subject to flooding and low summer flows.

Brewery Creek has an early history of water quality degradation. In the 1980s, manure management problems had eliminated environmentally intolerant macroinvertebrate populations in the creek. In August 1990, dissolved oxygen dropped to 0 mg/L during a storm event. Since then biotic integrity has shown some improvement. According to the Wisconsin Department of Natural Resources (DNR), it is suspected that this improvement is the result of the installation of agricultural best management practices along the creek as a result of the Black Earth Creek Priority Watershed project that took place from 1985 to 1996. A study conducted between 1999 and 2002 revealed improved conditions in Brewery Creek and demonstrated that subdivision development with stormwater management and erosion controls can provided sufficient protection against degradation to a receiving stream.[2] The stream now supports brown trout that migrate upstream from Black Earth Creek.

Unnamed Tributary to Black Earth Creek

The northwestern half of the proposed amendment area drains west to a small tributary that drains to a 4.9 mile unnamed tributary to Black Earth Creek. Little information is available for this tributary. It's current and attainable use is listed by DNR as Fish and Aquatic Life. Lacking a more specific use designation subcategory, the stream is considered fishable and swimmable and is not considered impaired.

Black Earth Creek

From its mouth at Blue Mounds Creek in Iowa County (mile 0) to the confluence with Vermont Creek, just west of the Village of Black Earth (mile 11.08), the existing biological use of Black Earth Creek is classified as Fish and Aquatic Life water and the attainable use is classified as a warmwater sport fishery. This section supports a warm water sport fishery that includes smallmouth bass. Upstream of this point, including the segments along the Village of Black Earth and Village of Cross Plains, Black Earth Creek is classified a (Class I) cold water trout fishery.

From its mouth at Blue Mounds Creek in Iowa County (mile 0) to the confluence with Vermont Creek, just west of the Village of Black Earth (mile 11.08), Black Earth Creek is proposed for inclusion on the state 303d list of impaired waters for degraded biological community from unknown point source and nonpoint source pollution. From just west of the Village of Black Earth (mile 11.08) to its confluence with Garfoot Creek (mile 16.83), Black Earth Creek is also proposed for inclusion on the state 303d list of impaired waters for degraded biological community and elevated water temperature from unknown point source and nonpoint source pollution. A Total Maximum Daily Load (TMDL) has not been established for these segments of Black Earth Creek. Upstream segments of Black Earth Creek, including the segments along the Village of Cross Plains, are classified as outstanding and exceptional streams and are not proposed for inclusion on the state 303d list of impaired waters.

The DNR has a monitoring station on Black Earth Creek downstream of the Village of Cross Plains wastewater treatment plant at STH 14. Chloride monitoring results between 2009 and 2013 show that chlorides levels have averaged 51 mg/L, well below the Chronic Aquatic Toxicity level of 395 mg/L.

[2] Selbig, W. et al. 2004. *Hydrologic, Ecologic, and Geomorphic Responses of Brewery Creek to Construction of a Residential Subdivision, Dane County, WI. 1999-2002.* USGS Scientific Investigations Report 2004-5156.

Springs

The Wisconsin Geological and Natural History Survey (WGNHS) maintains an inventory of springs in Dane County and throughout the state. There are no known springs in or near the proposed amendment area. The cold water portion of Black Earth Creek is fed by a series of spring complexes including a large spring complex (totaling approximately 1.1 cfs) on DNR land west (downstream) of the Village of Cross Plains (see Map 5) and a small spring in the headwaters northwest of the City of Middleton. Springs represent groundwater discharge that is visible to the casual observer. Actually, groundwater discharge generally occurs along the entire length of perennial streams and is the source of stream baseflow. The regional groundwater model is a useful tool for evaluating different configurations and scenarios of municipal groundwater well withdrawals on these stream systems.

Groundwater

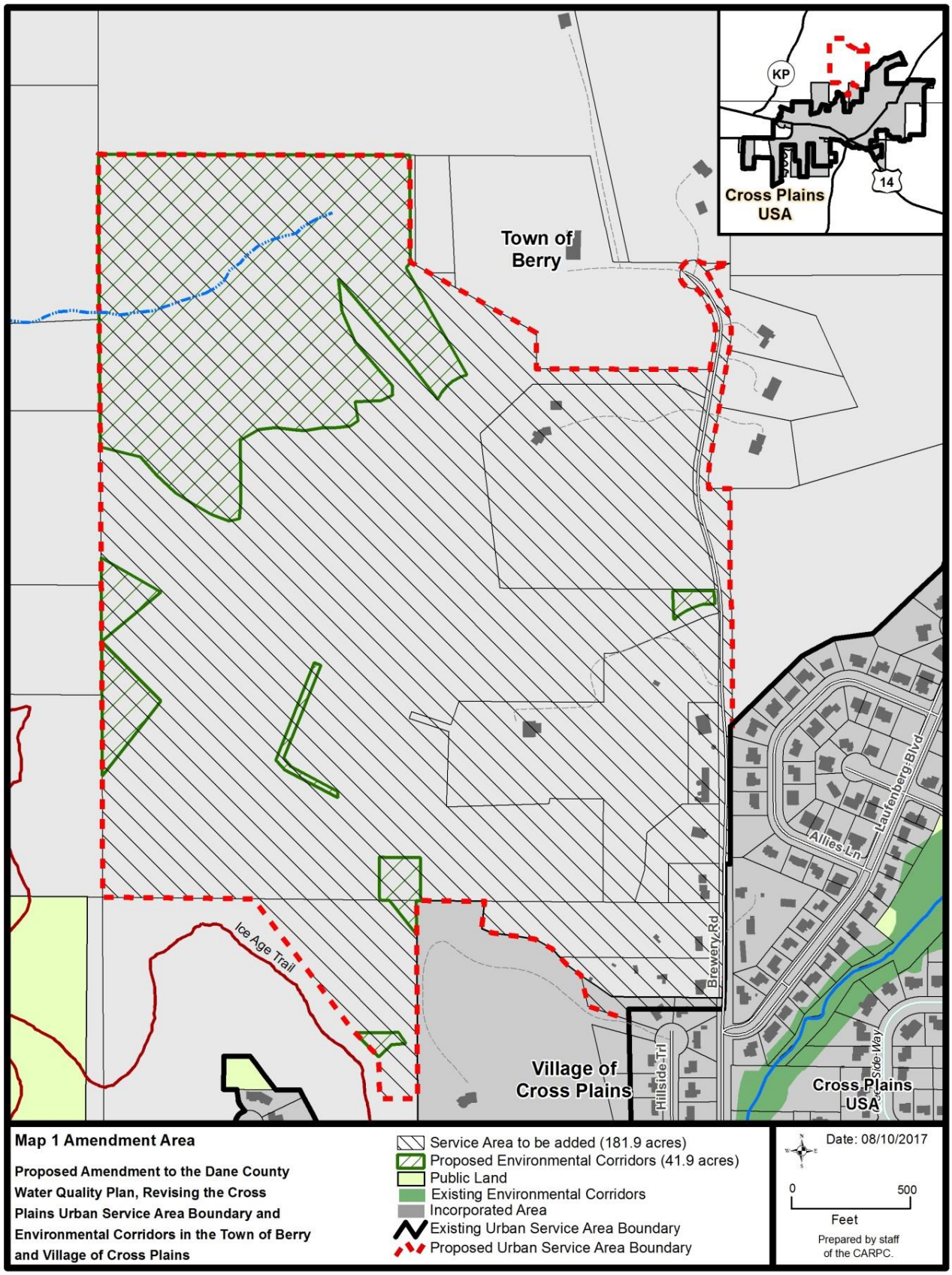
Groundwater modeling, using the 2016 Groundwater Flow Model for Dane County developed by the Wisconsin Geological and Natural History Survey, shows that baseflow in Upper Brewery Creek downstream of the amendment area (see Map 10 and Table 4) has decreased from 2.07 cubic feet per second (cfs) during pre-development conditions (no well pumping) to 1.81 cfs in 2010. The modeling shows that baseflow in Black Earth Creek downstream from Brewery Creek has decreased from 13.24 cfs during pre-development conditions to 11.15 cfs in 2010. These reductions are due to the cumulative effects of well water withdrawals from multiple municipalities in the groundwatershed.

In 2012, the WGNHS published a report, *Groundwater Recharge in Dane County, Wisconsin, Estimated by a GIS-Based Water-Balance Model*, estimating the existing groundwater recharge rates in Dane County based on the soil water balance method. The study estimates that the existing groundwater recharge rate in the amendment area ranges from 9 to 14 inches per year, with the highest rates in the western side of the amendment area.

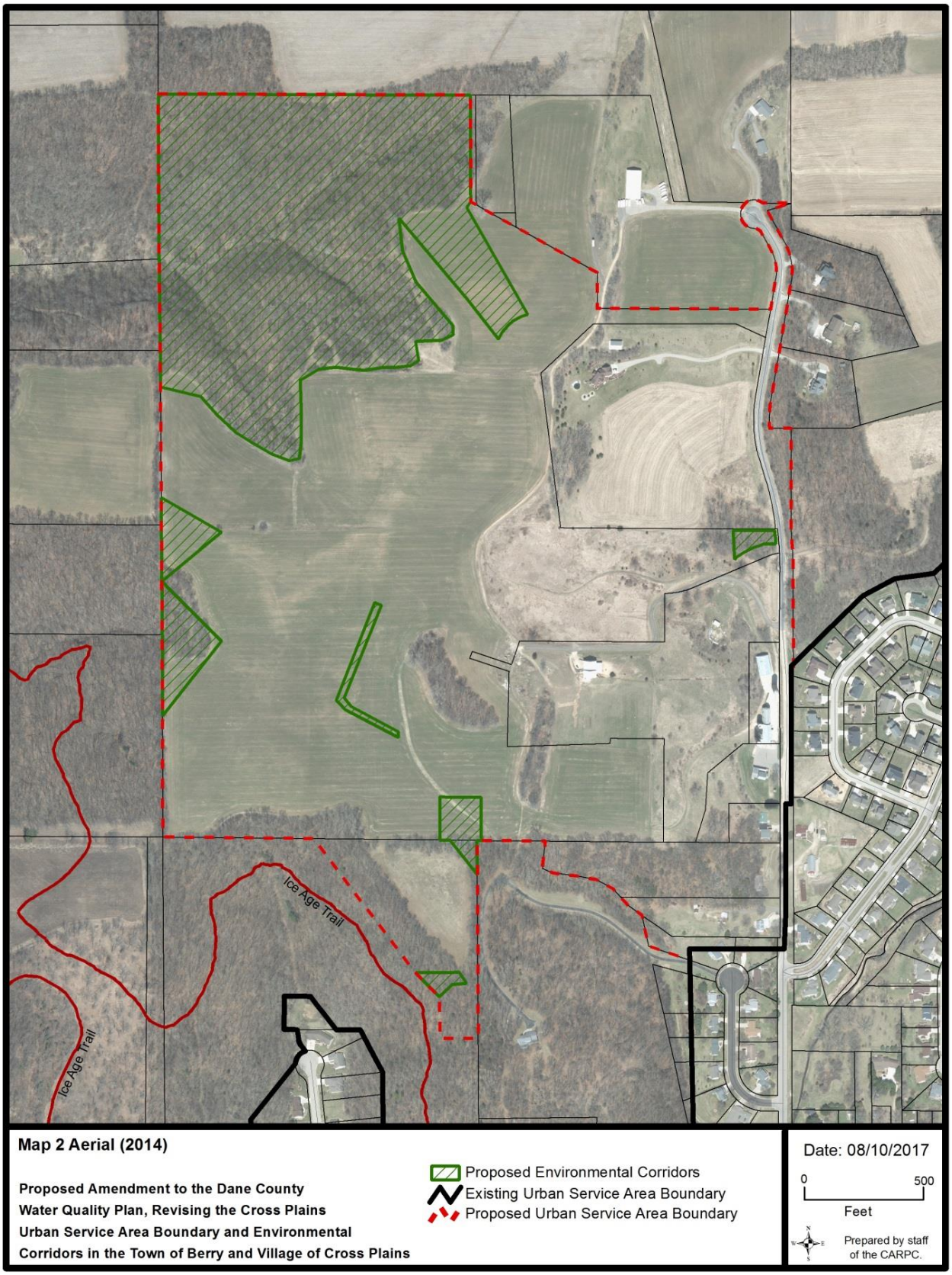
Endangered Resources

The DNR Bureau of Endangered Resources maintains a database representing the known occurrences of rare plants, animals, and natural communities that have been recorded in the Wisconsin Natural Heritage Inventory. A screening review of this database conducted by Regional Planning Commission staff identified a threatened plant species, an endangered butterfly, and three species of significant concern (an insect, snake, and plant) within a one-mile radius of the amendment area. According to the Sundance Development Plan, the property owner has applied to the DNR for a formal endangered resources review and there were none identified.

Map 1 - Amendment Area



Map 2 – Aerial


Ice Age Trail
Ice Age Trail
Map 2 Aerial (2014)
Proposed Amendment to the Dane County Water Quality Plan, Revising the Cross Plains Urban Service Area Boundary and Environmental Corridors in the Town of Berry and Village of Cross Plains
Proposed Environmental Corridors
Existing Urban Service Area Boundary
Proposed Urban Service Area Boundary
Date: 08/10/2017
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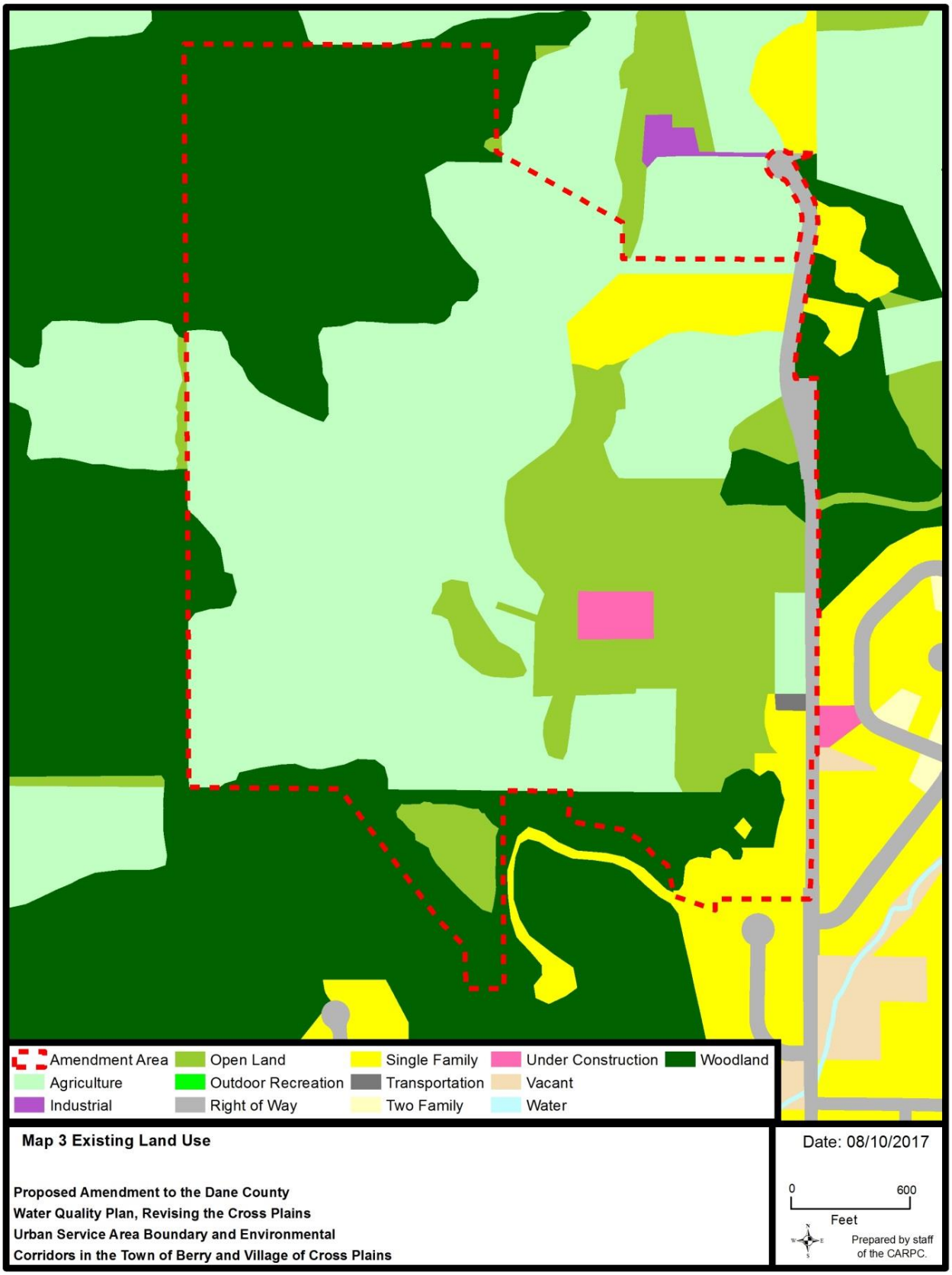
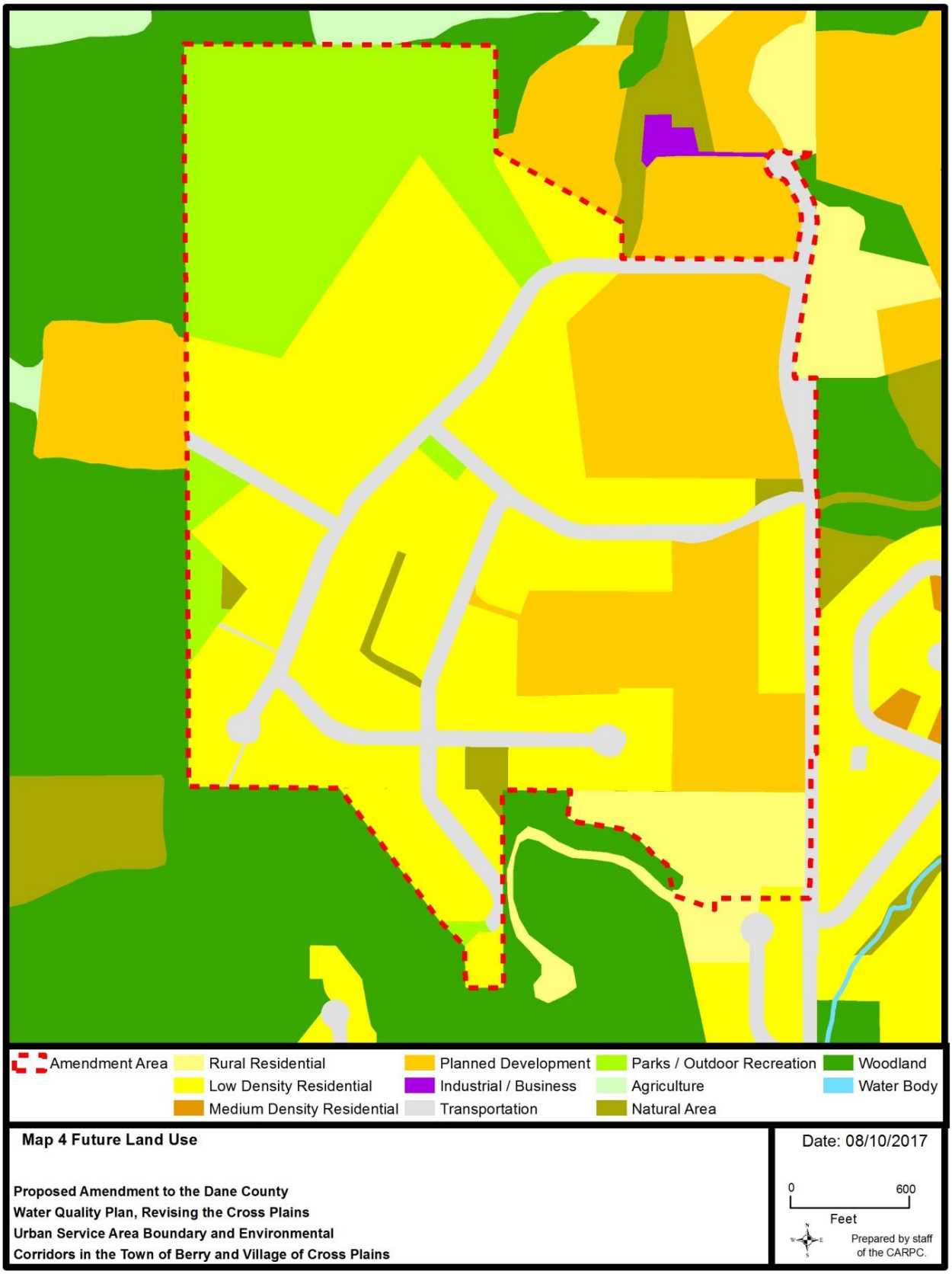
Prepared by staff of the CARPC.

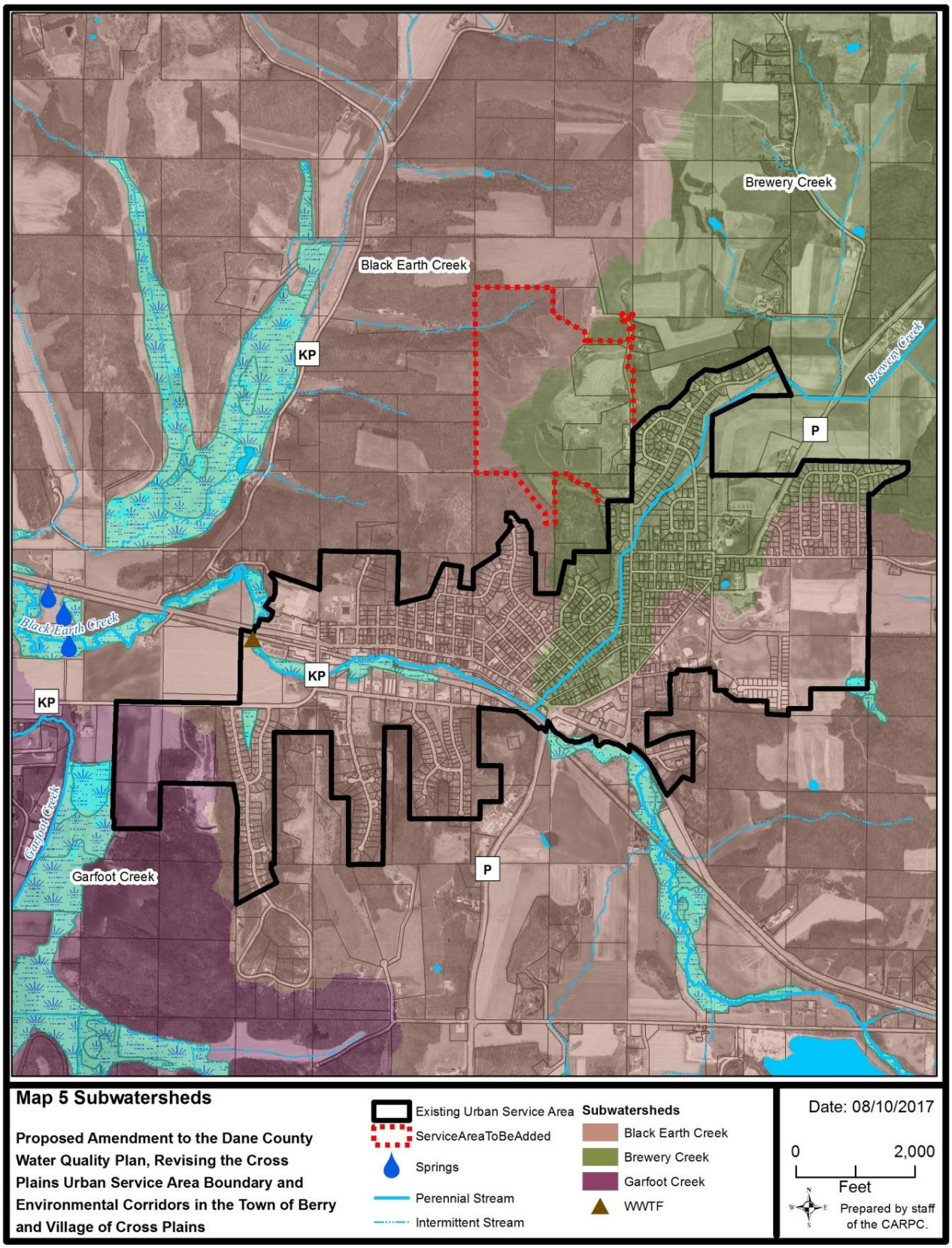
Map 3 – Existing Land Use



Map 4 – Planned Land Use



Map 5 - Subwatershed Map



Soils and Geology

The amendment area Land Type Associations of Wisconsin is split between the Hills and Valleys – Wisconsin River Drainage Association to the west and the Roxbury Hills association to the east. The Land Type Associations of Wisconsin classifies the surficial geology of this area as well drained and moderately well drained silty and loamy soil with a silt loam or sandy loam surface over noncalcareous clayey or loamy residuum or over silty loess; most areas over limestone, sandstone, or shale bedrock and the Roxbury Hills area as hilly eroded moraine with nearly level to undulating valley floors. Soils are predominantly well drained silt and loam over sandstone or dolomite calcareous sandy loam till, or calcareous gravelly sandy outwash.

Surface elevations in the amendment area range from around 930 feet to 1130 feet. As is common throughout the Driftless Area, the amendment area includes areas of steep (> 12%) slopes with some areas of very steep (>20%) slopes, primarily in in the northwest corner of the amendment area draining to the unnamed intermittent stream (see Map 6). Riparian steep slopes (>20%) have been included in environmental corridors.

According to the Natural Resource Conservation Service (NRCS) Soil Survey of Dane County, the soils are primarily in the Dodge-St. Charles-McHenry association. The Dodge-St. Charles-McHenry association soils are moderately well drained and well drained, deep silt loams. The Table 2 shows detailed classification for soils in the amendment area (see Map 7). Table 3 shows important soil characteristics for the amendment area (see Map 7).

The Port Byron and Seaton soils (the PrC, SmC2 and SmD2, map units) are not hydric, but they can have a seasonal (April to June) zone of water saturation within 5 feet of the ground surface, but these soils are classified as moderately well drained. Soils with seasonal high water tables that are also classified as well drained or moderately well drained generally do not pose limitations for buildings with basements.

According to Wisconsin Geological and Natural History Survey mapping, the majority of bedrock within the amendment area is in the Prairie du Chien Group, which is dolomite, minor sandstone, cherty dolomite; vuggy, sandy, and oolitic, consisting of two formations, the Shakopee and the Oneota. It varies in thickness from 145 feet in eastern Dane County to 220 feet in western Dane County. The bedrock under the southeast and northwest corners of the amendment area is in the Trempealeau Group, which is quartz sandstone, dolomitic siltstone, silty dolomite, and sandy dolomite, consisting of two formations, the Jordan and the underlying St. Lawrence Formations, which were combined as one mapping unit. The bedrock thickness is about 75 feet, where not eroded. The depth to bedrock generally ranges from 5 to 50 feet in the eastern half of the amendment area. The depth to bedrock in the western half of the amendment area is 2 to 3 feet, based on NRCS Soil Survey data (See Map 8).

There is no minimum separation distance for roofs draining to surface infiltration practices. But, the Dane County ordinance requires infiltration practices to be located so that the separation distance between the bottom of the infiltration system and the elevation of seasonal high groundwater or the top of bedrock is at least 5 feet for residential arterial roads and 3 feet for other impervious surfaces.

As is common throughout much of the upper Midwest, karst features such as enlarged bedrock fractures are prevalent in the local dolomite uplands. Karst features such as vertical fractures and conduits provide primary pathways for groundwater movement and can dramatically increase groundwater susceptibility when present. The location of karst features are difficult to predict, and the thickness and type of the overlying soil greatly affects how much water drains into them. Where clay soils are thick, infiltration rates are likely to be very low. However, where bedrock fractures are near the surface infiltration rates can be very high. Based on the WGNHS Karst Potential map, a majority of the amendment area is within an area where the depth to bedrock over potential karst units is 0 to 50 feet. The Wisconsin Department of Natural Resources Conservation Practice Standard 1002 - Site Evaluation for Stormwater Infiltration requires field verification for

areas of the development site considered suitable for infiltration. This includes a site assessment for karst features in this area.

Table 2
Soils Classification

Soil	% of Area	General Characteristics
McHenry Silt Loam; MdC2	28.0	Deep, well drained, gently sloping to moderately steep soils on glaciated uplands. Soils have medium fertility, moderate permeability, and a moderate to severe hazard of erosion. Poses slight to moderate limitations for development due to slopes, shrink/swell potential and low bearing capacity.
Fivepoints Silt Loam; 161D2	20.3	Well drained, silty and loamy stream deposits. Soils have high fertility, moderate permeability and a moderate to severe hazard of erosion. Poses severe limitation for development due to depth to bedrock, slope, shrink/swell potential, and low bearing capacity.
Fivepoints Silt Loam; 161C2	17.5	Well drained, silty and loamy stream deposits. Soils have high fertility, moderate permeability and a moderate to severe hazard of erosion. Poses moderate to severe limitation for development due to depth to bedrock, low bearing capacity and shrink/swell potential.
Seaton Silt Loam; SmD2	10.8	Deep, moderately well drained, sloping to steep soils on glaciated uplands. Soils have high fertility, moderate permeability, and hazard of erosion. Poses severe limitations for development due to frost heave potential, steep slopes, and low bearing capacity.
Kidder Loam; KrE2	8.7	Deep, well drained, gently sloping to very steep soils on glaciated uplands. Soils have medium fertility, moderate permeability, a very severe hazard of erosion, and are moderately droughty. Poses severe limitations for development due to steep slopes, shrink/swell potential and low bearing capacity.
New Glarus Silt Loam; NeB2	5.7	Moderately deep, well drained, gently sloping to steep soils on uplands. Soils have medium fertility, moderate permeability, and a severe hazard of erosion. Poses severe limitations for development due to depth to hard bedrock, slope and shrink/swell potential.
Fivepoints Silt Loam; 161E	4.1	Well drained, silty and loamy stream deposits. Soils have high fertility, moderate permeability and a moderate to severe hazard of erosion. Poses severe limitation for development due to depth to bedrock, slope, shrink/swell potential, and low bearing capacity.
Seaton Silt Loam; SmC2	3.9	Deep, moderately well drained, sloping to steep soils on glaciated uplands. Soils have high fertility, moderate permeability, and hazard of erosion. Poses severe limitations for development due to frost heave potential and low bearing capacity.
Dodge Silt Loam; DnC2	0.4	Deep, well drained, gently sloping and sloping soils on glaciated uplands. Soils have high fertility, moderate permeability, and a moderate to severe hazard of erosion. Poses moderate limitations for development due to slope, shrink/swell potential and low bearing capacity.
Kidder Loam; KdD2	0.3	Deep, well drained, gently sloping to very steep soils on glaciated uplands. Soils have medium fertility, moderate permeability, and a very severe hazard of erosion and are moderately droughty. Poses severe limitations for development due to steep slopes.
Port Byron Silt Loam; PrC	0.3	Deep, moderately well drained, gently sloping and sloping soils on colluvial valley foot slopes. Soils have high fertility, moderate permeability, and a severe hazard of erosion. Poses severe limitations for development due to frost heave potential and low bearing capacity.
Newglarus-Dunbarton Silt Loam; 1180C2	0.1	Well drained, silty and loamy stream deposits. Soils have high fertility, moderate permeability and a severe hazard of erosion. Poses severe limitation for development due to depth to bedrock, frost heave potential, slope, shrink/swell potential, and low bearing capacity.
Dodge Silt Loam; DnB	0.0	Deep, well drained, gently sloping and sloping soils on glaciated uplands. Soils have high fertility, moderate permeability, and a moderate to severe hazard of erosion. Poses moderate limitations for development due slope and shrink/swell potential.

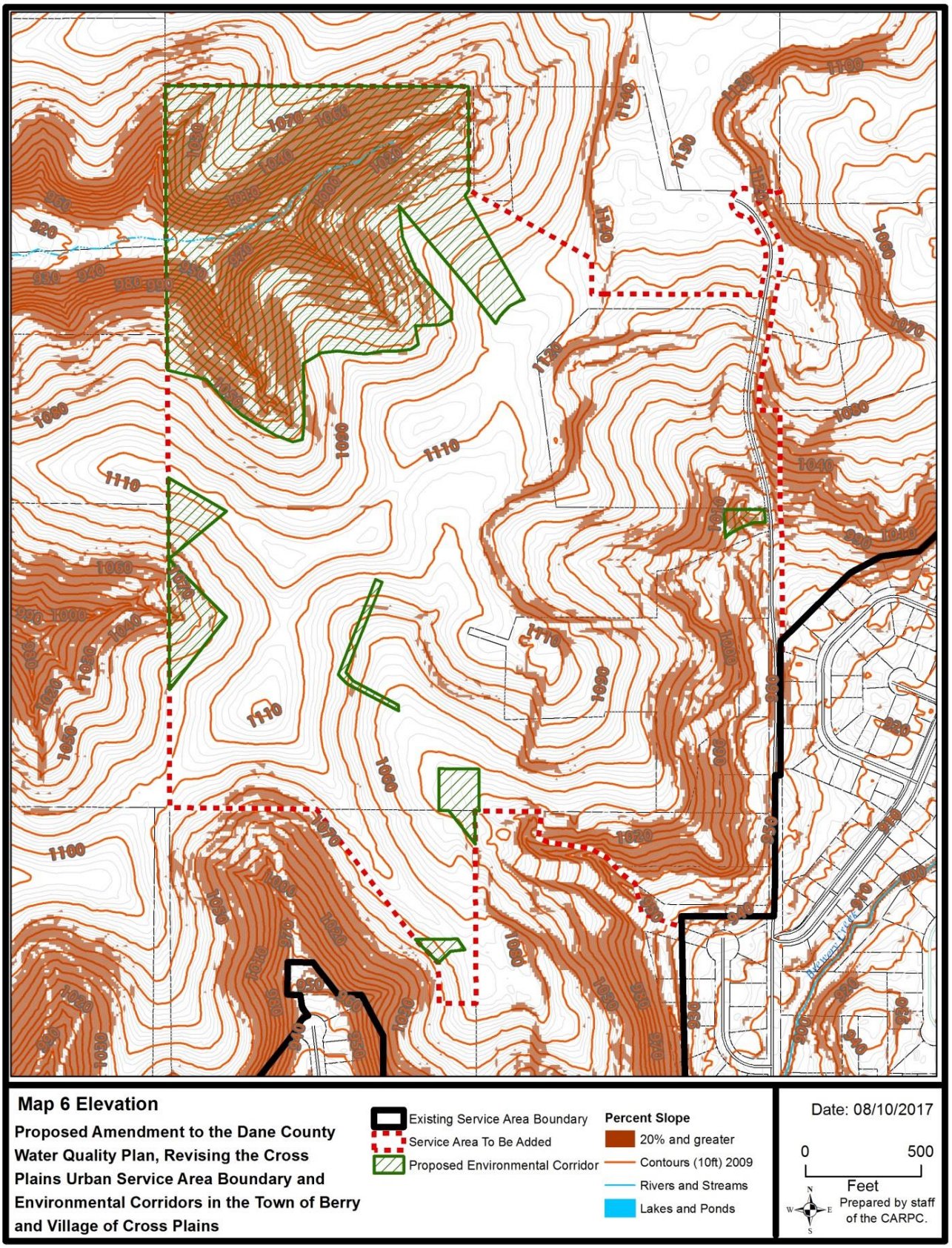
Source: Soil Survey Geographic data for Dane County developed by the USDA Natural Resources Conservation Service

Table 3
Soils Characteristics

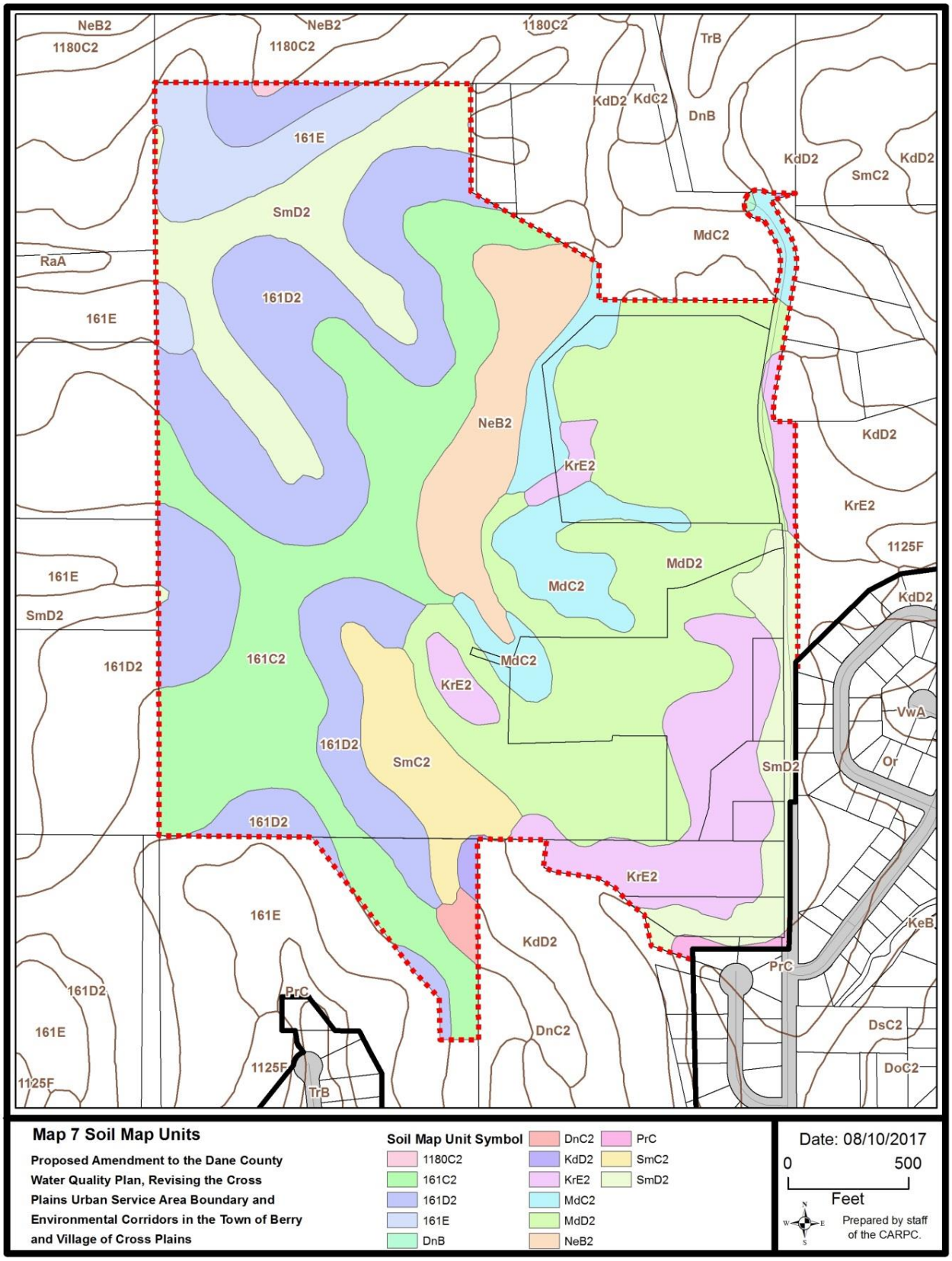
Characteristic	Soil Map Symbols (see Map 7)	% of Area
Prime Agricultural Soils	DnC2, NeB	6.1
Hydric Soils (Indicates Potential / Restorable Wetlands)	None	0
Soils with Seasonal High Water Table (< 5')	PrC, SmC2, SmD2	15.0
Soils Associated with Steep Slopes (> 12%)	161D2, 161E, KdD2, KrE2, SmD2	44.1
Soils Associated with Shallow Bedrock (< 5')	1180C2, 161C2, 161D2, 161E, NeB2, PrC	47.9
Poorly Drained Soils	None	0
Best Potential for High Rates of Infiltration in Subsoils	KdD2, KrE2,MdC2, PrC, SmC2, SmD2	51.9

Source: Soil Survey Geographic data for Dane County developed by the USDA Natural Resources Conservation Service

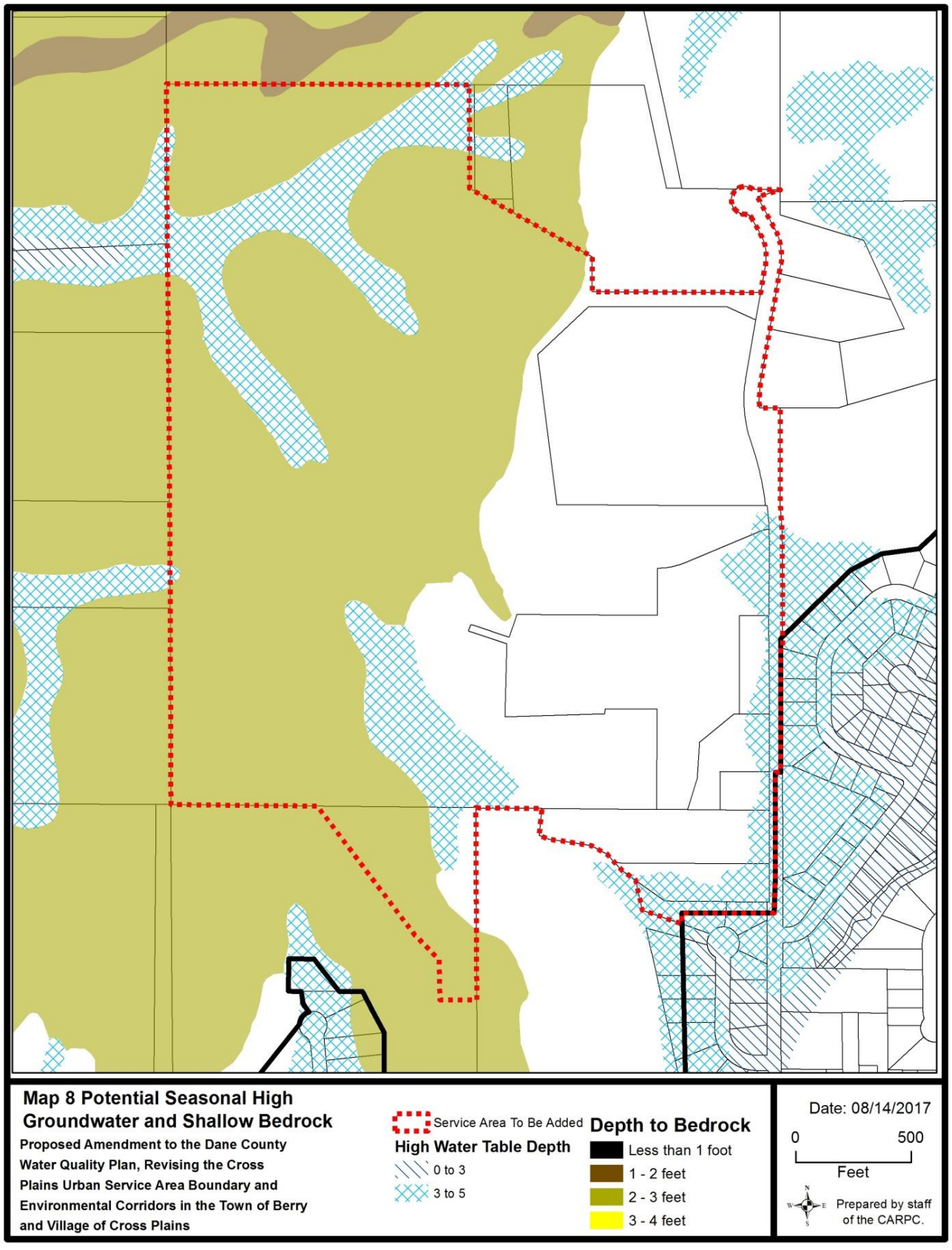
Map 6 - Elevations



Map 7 - Soil Type



Map 8 – Potential Seasonal High Groundwater and Shallow Bedrock



2) Proposed Urban Services

a) Parks and Open Space

Two Village parks, a small "tot-lot" pocket park and a larger possible neighborhood park and dog park are planned for the Sundance Development, comprising nearly 4 acres. An additional 28.9 acres of undevelopable steep wooded slopes on the western half of the site is planned to be reserved as Parkland Conservancy.

The Village has a woodlands overlay district and a hillside/hilltop overlay district which also provides zoning protection to preserve these natural resource areas as open space even when they are part of private lots.

b) Public Water System

The Village's average municipal water demand is 420,000 gallons per day (gpd) and is provided by two high capacity wells. Well #1 (410 gpm) is located at the end of East St. and Well #2 (600 gpm) is located in Baer Park, with a combined capacity to deliver 1,300,000 gpd. The Village's water system also currently has two storage tanks with an average water elevation of 1037.3 feet. The estimated average daily water demand for the amendment are will be 17,160 gpd based on 143 existing and new residential units with a demand of 120 gpd per unit.

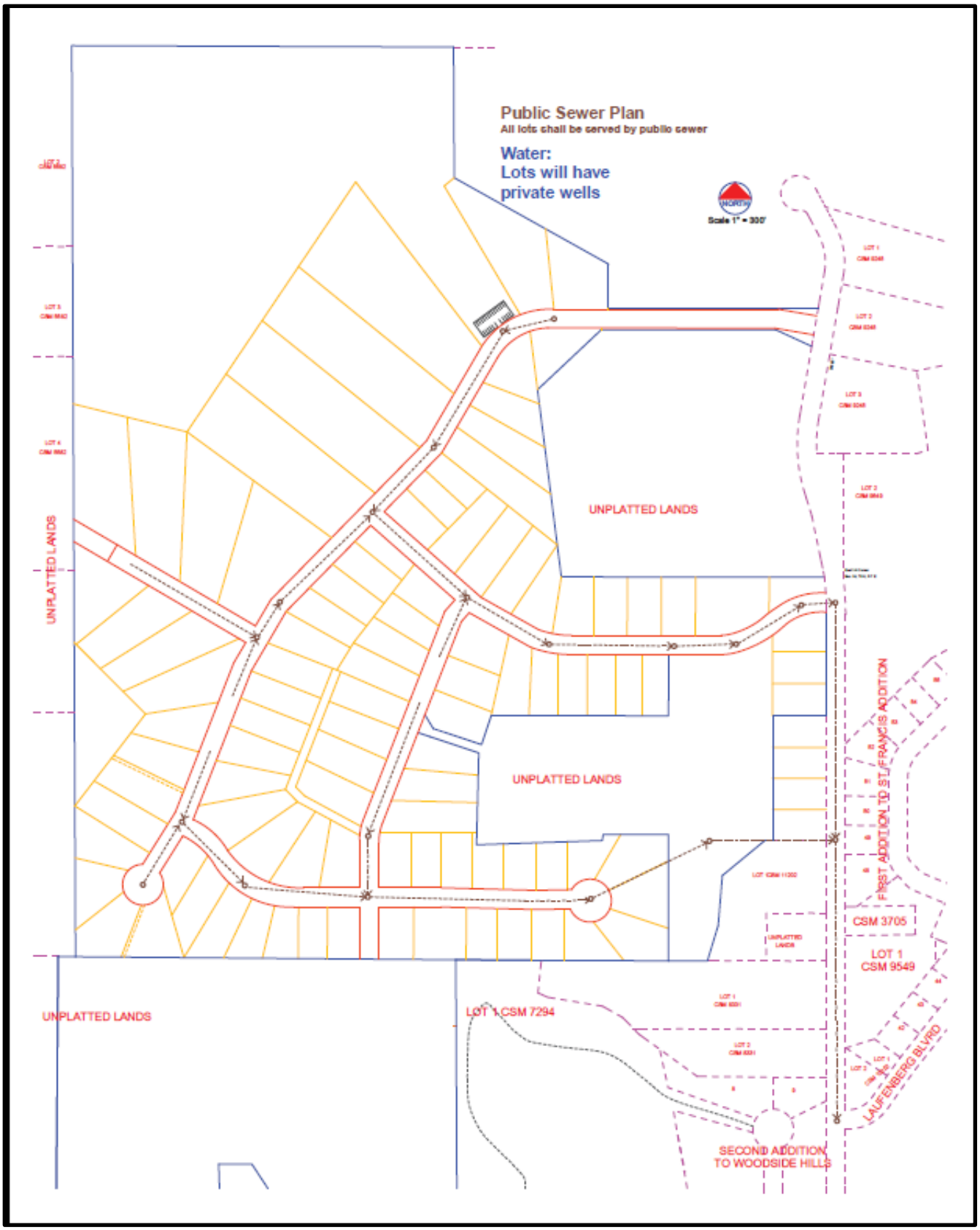
The elevation in the proposed Urban Service Area ranges from 1030 to 1110 feet. A study evaluating the potential for public water service to high elevation development areas was completed in 2009 by Town and Country Engineering. The study found that providing water service to the proposed service area would require a completely separate water system with a new storage facility and two independent water supply sources that would be unable to serve intermediate elevations between the proposed service area and the existing municipal system due to excessive operating pressures. The initial capital investment, in 2018 dollars, is estimated to be $3,500,000. In addition, the increase in operations and maintenance costs are estimated to be $160,000 annually. For this reason, the Village is proposing that private wells be installed for each residential lot.

c) Wastewater

Sanitary sewer service will be provided to the amendment area through an 1,850 foot extension along Brewery Road, connecting to the existing municipal sanitary sewer system at a manhole near the intersection of Brewery Road and Laufenberg Boulevard at the southeast corner of the amendment area (see Map 9). Due to topography, the Village anticipates that a grinder pump will be required to service the proposed residential lots along the west-central edge of the amendment area.

The Village estimates that the amendment area will generate an average of 23,300 gpd (16 gpm), assuming 2.5 persons per home and 65 gpd per person. Using a peaking factor of 4, it is estimated that the amendment area would generate a peak flow of 65 gpm. The estimate is consistent with historical wastewater generation rates in the Village. The Village has determined that the Brewery Road interceptor has an existing capacity of 0.60 cubic feet per second (cfs). Including the proposed development, at full buildout the peak flow would increase to 0.64 cfs. The Brewery Road interceptor is due for replacement. The Village will replace the Brewery Road interceptor with additional capacity prior to full buildout of the amendment area. The downstream interceptors all have sufficient capacity to accommodate the anticipated increase in flow resulting from the amendment area.

Map 9 – Planned Sanitary Sewer Service



Waste Water Treatment Facility

Cross Plains operates a wastewater treatment facility (WWTF), upgraded in 2008, that provides secondary treatment and nutrient removal. Treatment units include mechanical influent step screening, selector basins to enhance biological phosphorus removal, two oxidation ditches for activated sludge secondary treatment, final clarification, seasonal ultraviolet disinfection and effluent diffused and cascade aeration. The wastewater treatment facility has a design capacity of 0.593 mgd and received an average of 0.293 mgd in 2015, including infiltration and inflow. The Village has seen a decrease in flow from a high of 0.457 mgd in 2013 at the treatment facility due to sanitary sewer replacement projects that reduced the amount of infiltration and inflow from old sewers on Lagoon Street and Main Street. Based on a 5-year average incoming flow centered around 2010, it is expected that the WWTF will reach 90% of current hydraulic design capacity around 2025 based on current projected growth rate assumptions. Biosolids are aerobically digested and thickened with a gravity belt thickener before being hauled to the Dane-Iowa WWTF for further Class A sludge treatment and eventual land application on WDNR approved agricultural fields.

The Cross Plains WWTF has not had any issues meeting its WPDES permit limits for the quality of effluent discharged to Black Earth Creek according to their 2015 Compliance Maintenance Annual Report. In 2015, the effluent monthly average (C)BOD ranged from 3 to 20 mg/L, well below the 23 to 30 mg/L permit limit. The effluent monthly average Total Suspended Solids ranged from 3 to 7 mg/L, well below the 23 to 30 mg/L permit limit. The effluent monthly average phosphorus ranged from 0.1 to 1.2 mg/L, below the current 1.5 mg/L permit limit. Monthly temperature limitations were added to the current permit for the months of August through November.

d) Stormwater Management System

The preliminary stormwater management plan for the amendment area includes a hybrid swale-based road profile and a network of four stormwater management facilities. The swale-based road profile replaces a traditional curb-and-gutter section in a large portion of the development area and provides water quality and quantity treatment where a traditional inlet and piped conveyance system does not. These facilities will generally be strategically located to adequately provide water quality treatment (80% TSS reduction) followed by volume reduction facilities, which will provide for annual stay-on (100% stay-on). It is anticipated that infiltration performance will further reduce TSS (and other pollutants such as Total Phosphorus) from stormwater discharges as well as reduce the temperature. Collectively, the stormwater facilities will provide peak discharge rate control to account for storms up to and including the 100-year rainfall event. The stormwater facilities will be owned and maintained by the Village of Cross Plains.

According to the USDA soil classifications for the amendment area, the soils underlying the proposed western stormwater management facilities typically exhibit shallow bedrock within 2-3 feet of the surface and the southern and eastern stormwater management facilities typically exhibit shallow groundwater within 5 feet of the surface, both of which are limitations to infiltration of non-roof runoff. The Wisconsin Department of Natural Resources Conservation Practice Standard 1002 - Site Evaluation for Stormwater Infiltration requires field verification for areas of the development site considered suitable for infiltration. This includes a site assessment for karst features on the site to locate infiltration facilities appropriately so that performance can be maximized while protecting groundwater resources. Additionally, as a large percentage of the site soils are characterized by shallow bedrock and groundwater (48% of site by bedrock and 15% by groundwater), it is recommended that the Village consider distributed infiltration facilities, such as terrace bioretention, residential rain gardens and porous pavement, upstream of the proposed stormwater management facilities locations should limiting conditions be found at the current conceptual locations.

Performance Standards

The Village of Cross Plains proposes stormwater management performance measures to meet or exceed standards required by the State of Wisconsin (NR 151), Dane County (Chapter 14), and Village of Cross Plains (Chapter 65) stormwater regulations, as follows:

1) Require post-construction sediment control (reduce total suspended solids leaving the site by at least 80%, with a minimum of 60% of that control occurring in a retention pond prior to infiltration) for the 1-year, 24-hour design storm. This is consistent with the standards currently required by Dane County.

2) Require post-construction peak runoff rate control for the 1-, 2-, 10-, and 100-year, 24-hour design storms to "pre-development" peak runoff rates. This is consistent with the range of design storms currently required by Dane County.

3) Require post-development stay-on volume of at least 100% of pre-development stay-on volume. This is more protective than the stay-on standard for new development currently required by Dane County regulations.

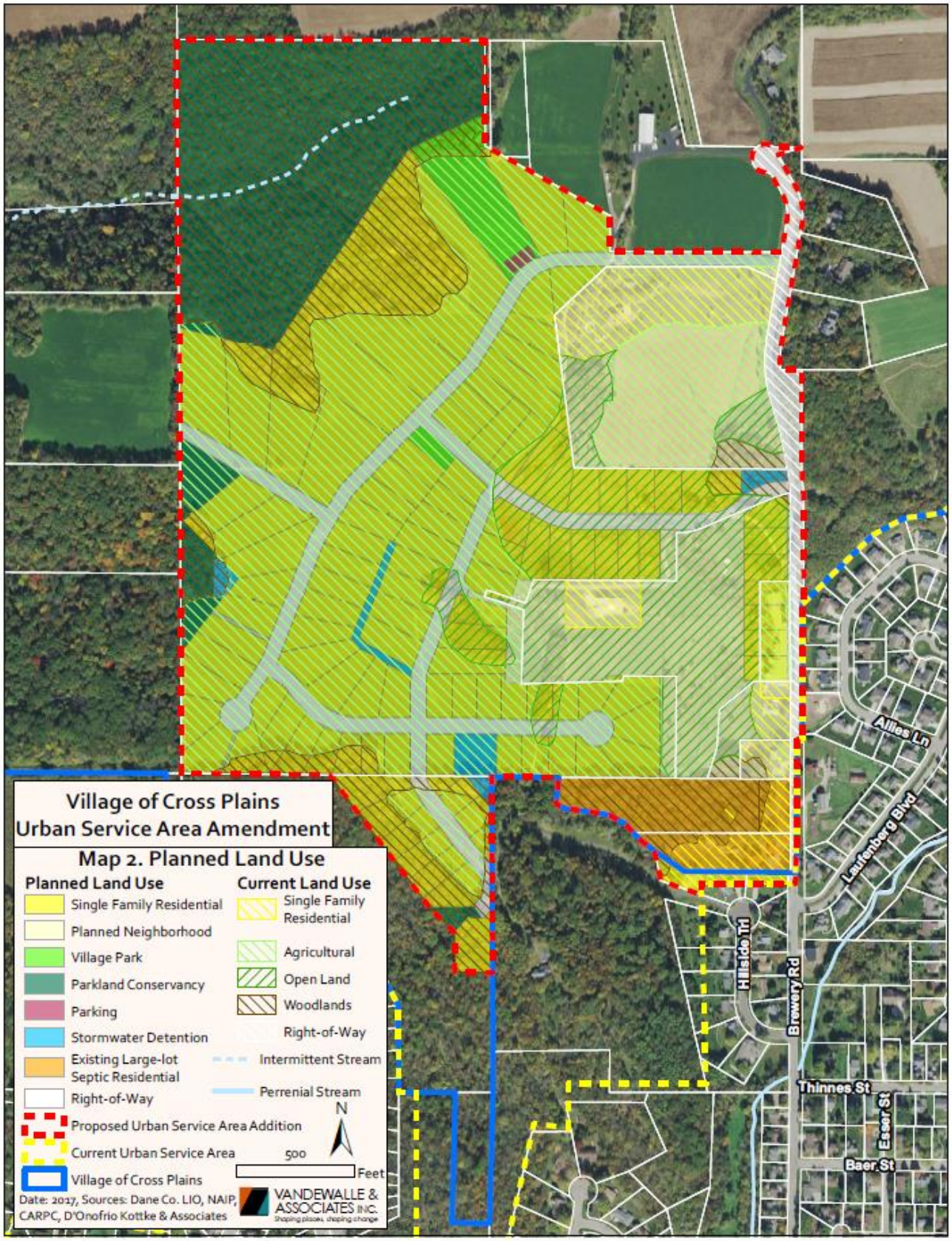
4) Maintain pre-development groundwater annual recharge rate of 9 to 14 inches per year for this area as estimated by the Wisconsin Geological and Natural History Survey in a 2012 report titled "Groundwater Recharge in Dane County, Wisconsin Estimated by a GIS-Based Water Balance Model." This is consistent with the standards currently required by Dane County.

5) Reduce the temperature of stormwater discharge to meet WDNR cold water standards. This is consistent with the standards currently required by Dane County.

e) Environmental Corridors

The Village has worked with Regional Planning Commission staff prior to submitting this application to establish environmental corridors that meet the adopted policies and criteria of the *Dane County Water Quality Plan*. The environmental corridor includes the intermittent stream and associated steep wooded. Approximately 41.9 acres of environmental corridors are proposed for environmentally sensitive areas (36.2 acres), stormwater management areas (2.1 acres), and parks (3.6 acres).

Map 10 – Proposed Stormwater Management System



3) Impacts and Effects of Proposal

a) Meeting Projected Demand

Current projections for 2040 suggest that an additional 782 residents and 419 housing units can be expected in the Cross Plains Service Area between 2010 and 2040. Land demand projections in 2010 estimated that a total of 112 additional acres of residential land would be needed for the Cross Plains Service Area. However, Department of Administration (DOA) preliminary population estimates for 2017 indicate that Cross Plains has already exceeded the projected 2020 population and is within a few dozen residents of reaching the projected 2025 population. The 2015 American Community Survey 5-Year Estimate placed the total number of households at around 1,498, exceeding the DOA projection for 2015 by about 50 housing units. The village is currently growing at a much faster rate than previously expected.

b) Phasing

The amendment area will develop in there phases of approximately 33 units each. Development will progress from the northernmost area to the south and then to the west.

c) Surface Water Impacts

Development creates impervious surfaces (i.e., streets, parking areas, and roofs) and typically alters the natural drainage system (e.g., natural swales are replaced by storm sewers). Without structural best management practices (i.e., detention basins and infiltration basins) this would result in increased stormwater runoff rates and volumes, as well as reduced infiltration. Without structural best management practices for erosion control, development would also cause substantial short-term soil erosion and off-site siltation from construction activities. Scientific research has well documented that without effective mitigation measures, the potential impacts of development on receiving water bodies can include the following:

- Flashier stream flows (i.e., sudden higher peaks)
- Increased frequency and duration of bankfull flows
- Reduced groundwater recharge and stream base flow
- Greater fluctuations in water levels in wetlands
- Increased frequency, level (i.e., elevation), and duration of flooding
- Additional nutrients and urban contaminants entering the receiving water bodies
- Geomorphic changes in receiving streams and wetlands

Natural drainage systems attempt to adapt to the dominant flow conditions. In the absence of mitigation measures, the frequency of bank-full events often increases with urbanization, and the stream attempts to enlarge its cross section to reach a new equilibrium with the increased channel forming flows. Higher flow velocities and volumes increase the erosive force in a channel, which alters streambed and bank stability. This can result in channel incision, bank undercutting, increased bank erosion, and increased sediment transport. The results are often wider, straighter, sediment laden streams, greater water level fluctuations, loss of riparian cover, and degradation of shoreland and aquatic habitat.

Since 2002, there have been stormwater management standards in effect at the state, county, and local level to require stormwater management and erosion control plans and structural best management practices to address the impacts of development on water quality, runoff volumes, peak flows, water temperature, and groundwater recharge.

The Village proposes to mitigate the urban nonpoint source impacts of the proposed development by requiring the implementation of various stormwater best management practices that are designed and constructed to meet or exceed current standards for

pollutant reduction, runoff volumes, peak flows, water temperature, and groundwater recharge. This will address the potential impacts of the proposed development on the receiving waters. To its credit, the Village of Cross Plains has voluntarily adopted a more stringent stormwater management requirement for new development by requiring pre-development runoff volume conditions be maintained (100% stay-on). This is a model for other communities in further reducing the urban nonpoint runoff impacts of development on receiving waters.

d) Groundwater Impacts

Without effective mitigation practices, as natural areas are converted to urban development the ground/surface water balance in streams and wetlands shifts from a groundwater-dominated system to one dominated more and more by surface water runoff, with subsequent reductions in stream quality and transitions to more tolerant biological communities.

Groundwater modeling indicates that the cumulative effects of year 2010 well water withdrawals from all municipalities have resulted in a 0.26 cfs decline in baseflow in Upper Brewery Creek immediately below the amendment area (see Map 11 and Table 4) compared to the pre-development (no pumping) baseflow of 2.07 cfs. An additional 0.18 cfs decline is anticipated by the year 2040, according to modeling, reducing the baseflow to 1.63 cfs. Similar reductions are shown for Lower Brewery Creek and in Black Earth Creek immediately downstream. According to the 2014 DNR report *Ecological Limits of Hydrologic Alteration in Dane County Streams*, significant change in the fish community status from 2010 conditions is not expected to occur as a result of the projected 2040 reduction in baseflow in Brewery Creek or Black Earth Creek. There is a very slight decrease in baseflow in Upper Brewery Creek (0.01 cfs) resulting from Sundance residents being served by shallow private wells, versus much deeper municipal wells drawing from regional sources.

The loss of baseflow from the cumulative effects of well water pumping is a regional issue, beyond the boundaries of a single Urban Service Area Amendment or even a single municipality. This is illustrated by the comparatively lower baseflow reductions due to just Village of Cross Plains municipal well water withdrawals shown in Table 5. This issue is discussed along with potential management options in the recently updated *Dane County Groundwater Protection Planning Framework* (Technical Appendix G of the Water Quality Plan).

Maintaining pre-development groundwater recharge also helps to maintain baseflow and mitigate this impact. The Village of Cross Plains proposes to maintain the pre-development annual recharge rate (estimated as 9 to 14 inches per year for this area according to the Wisconsin Geological and Natural History Survey study). Experience has shown that this criterion is generally met when 90% of pre-development runoff volume is maintained for the development area through infiltration measures, the Village goes beyond this by requiring 100% of pre-development runoff volume conditions be maintained. In addition, the riparian woodland, which generally function as groundwater recharge areas, have been preserved and placed in environmental corridors.

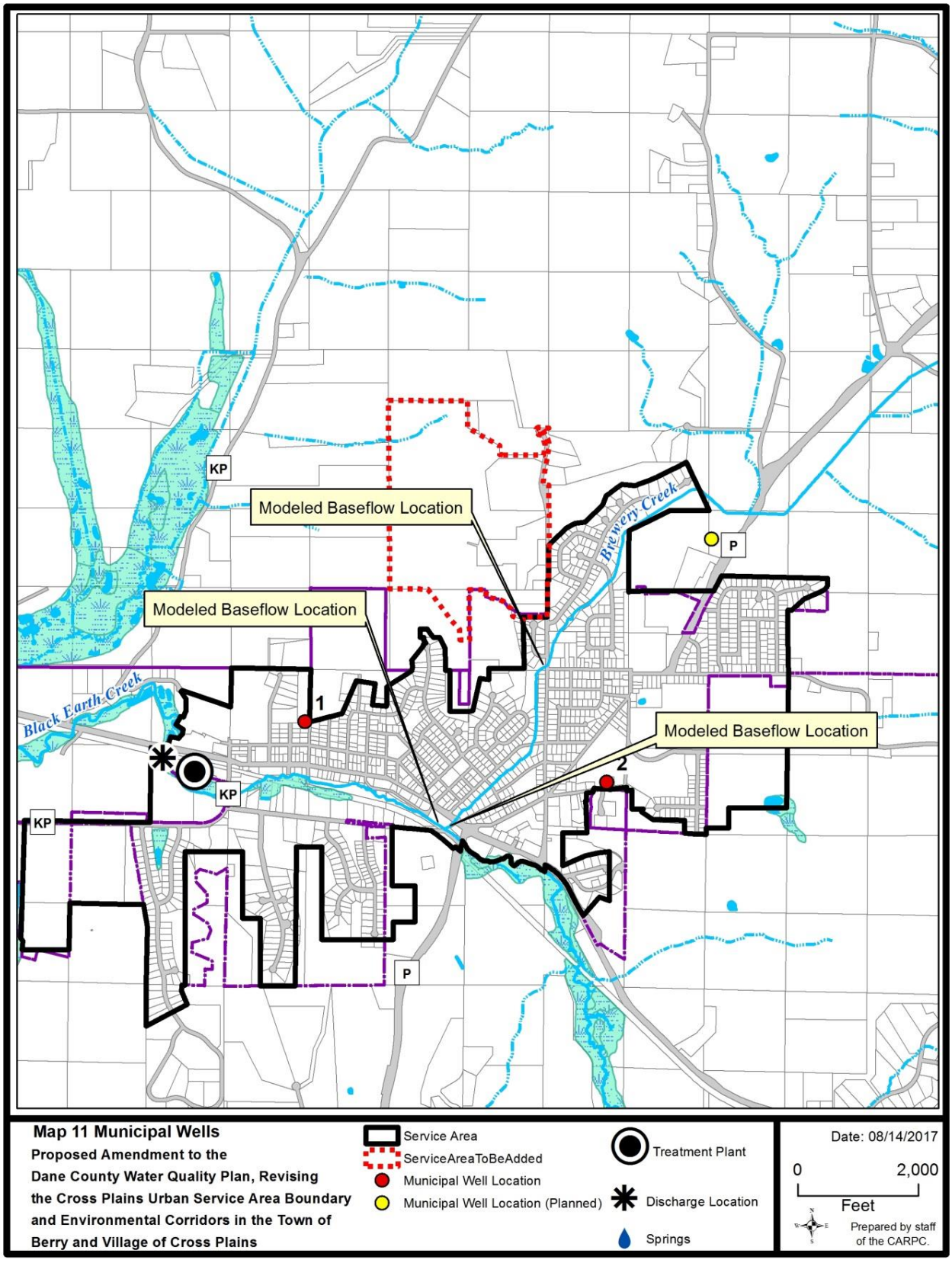
Table 4. All Municipal Wells			
Modeled baseflow results due to current and anticipated future municipal well water withdrawals (cfs)			
Stream	**Pre-Development**	**2010**	**2040***
Upper Brewery Cr.	2.07	1.81	1.63
Lower Brewery Cr.	2.68	2.35	2.18
Black Earth Cr. below Brewery Cr.	13.24	11.15	10.96
* assumes Sundance residents served by private wells			

Table 5. Cross Plains Wells Only			
Modeled baseflow results due to current and anticipated future municipal well water withdrawals (cfs)			
Stream	**Pre-Development**	**2010**	**2040***
Upper Brewery Cr.	2.07	2.01	1.83
Lower Brewery Cr.	2.68	2.58	2.41
Black Earth Cr. below Brewery Cr.	13.24	12.99	12.86
* assumes Sundance residents served by private wells			

4) Comments Received and Unresolved Issues

On June 19, 2017, the proposed USA Amendment was presented to the Town of Berry Board by representatives from the Village of Cross Plains at the Town Board's monthly meeting. At their July 17, 2017 meeting, the Town Board voted to neither support nor oppose the proposed USA Amendment. As of the time of posting of this staff analysis, no public comment related to this amendment request has been received.

Map 11 – Municipal Wells and Modeled Baseflow Locations



4) Conclusions and Staff Water Quality Recommendations

There is sufficient existing or planned (Brewery Road Interceptor replacement) wastewater collection system capacity to serve the proposed amendment area. There is sufficient existing treatment plant system capacity to serve the proposed amendment area.

Since 2002 there have been stormwater management standards in effect at the state, county, and local level to require stormwater management and erosion control plans and structural best management practices to address the impacts of development on water quality, runoff volumes, peak flows, water temperature, and groundwater recharge.

The Village proposes to mitigate the urban nonpoint source impacts of the proposed development by requiring the implementation of stormwater best management practices that are designed and constructed to meet or exceed current standards for pollutant reduction, runoff volumes, peak flows, water temperature, and groundwater recharge. This will address the potential impacts of the proposed development on the receiving waters. To its credit, the Village of Cross Plains has voluntarily adopted a more stringent stormwater management requirement for new development by requiring pre-development runoff volume conditions be maintained (100% stay-on). This is a model for other communities in further reducing the urban nonpoint runoff impacts of development on receiving waters.

While the large (0.8 acre) average lot size is an inefficient use of land resources and municipal water service will not be provided as is typically expected of urban development in a village, it is the Regional Planning Commission staff's opinion that the proposed amendment is consistent with water quality standards under Wis. Stat. § 281.15, with the conditions of approval identified below. Additional actions have also been recommended below to further improve water quality and environmental resource management.

a) Conditions

Regional Planning Commission staff recommends approval of this amendment, based on the land uses and services proposed, and conditioned on the continued commitment of the Village of Cross Plains to pursue the following:

1. Submit a detailed stormwater management plan for Regional Planning Commission staff review and approval (in conjunction with DCL&WCD staff) prior to any land disturbing activities in the amendment area. The stormwater management plan shall include the following:

    a. Install stormwater and erosion control practices prior to other land disturbing activities. Protect infiltration practices from compaction and sedimentation during land disturbing activities.

    b. Control peak rates of runoff for the 1-, 2-, 10-, and 100-year 24-hour design storms to pre-development levels, in accordance with the Village of Cross Plains Stormwater Ordinance.

    c. Maintain the post development stay-on volume to at least 100% of the pre-development stay-on volume for the one-year average annual rainfall period, in accordance with the Village of Cross Plains Stormwater Ordinance.

    d. Maintain pre-development groundwater recharge rates from the Wisconsin Geological and Natural History Survey's 2012 report, *Groundwater Recharge in Dane County, Wisconsin, Estimated by a GIS-Based Water-Balance Model* (a range of 9 to 14 inches/year for the amendment area) or by a site specific analysis, in accordance with the Village of Cross Plains Stormwater Ordinance.

e. Provide at least 80% sediment control for the amendment area based on the 1-year, 24-hour design storm, with a minimum of 60% of that control occurring prior to infiltration, in accordance with the Village of Cross Plains Stormwater Ordinance.

f. Reduce the temperature of stormwater discharge to meet WDNR cold water standards, in accordance with the Village of Cross Plains Stormwater Ordinance.

2. Conduct a field verification for areas of the development site considered suitable for infiltration including a site assessment for karst features as required by the Wisconsin Department of Natural Resources Conservation Practice Standard 1002 - Site Evaluation for Stormwater Infiltration.

3. Stormwater management facilities shall be placed in public outlots whenever feasible and designated as environmental corridor. Easements and perpetual legal maintenance agreements with the Village, to allow the Village to maintain stormwater management facilities if owners fail to do so, shall be provided for any facilities located on private property.

4. Delineate environmental corridors to include the intermittent stream, associated buffers, and riparian steep wooded slopes, and stormwater management areas to meet *Dane County Water Quality Plan* criteria for the delineation of environmental corridors. Submit plats showing environmental corridors for Regional Planning Commission staff review and approval prior to recording. Any environmental corridor on private property shall be protected by deed restrictions and neighborhood covenants.

b) Recommendations

It is also recommended that the Village of Cross Plains pursue the following:

1. Consider distributed infiltration facilities, such as terrace bioretention, residential rain gardens and porous pavement, upstream of the proposed stormwater management facilities locations should limiting conditions be found at the proposed infiltration locations.

2. Encourage the responsible use of deicers as part of the WI Salt Wise Partnership.

3. Work with Regional Planning Commission staff to develop a long term water supply plan for the Village using the regional groundwater model.

4. Conduct joint comprehensive planning with the Town of Berry and the Town of Cross Plains.